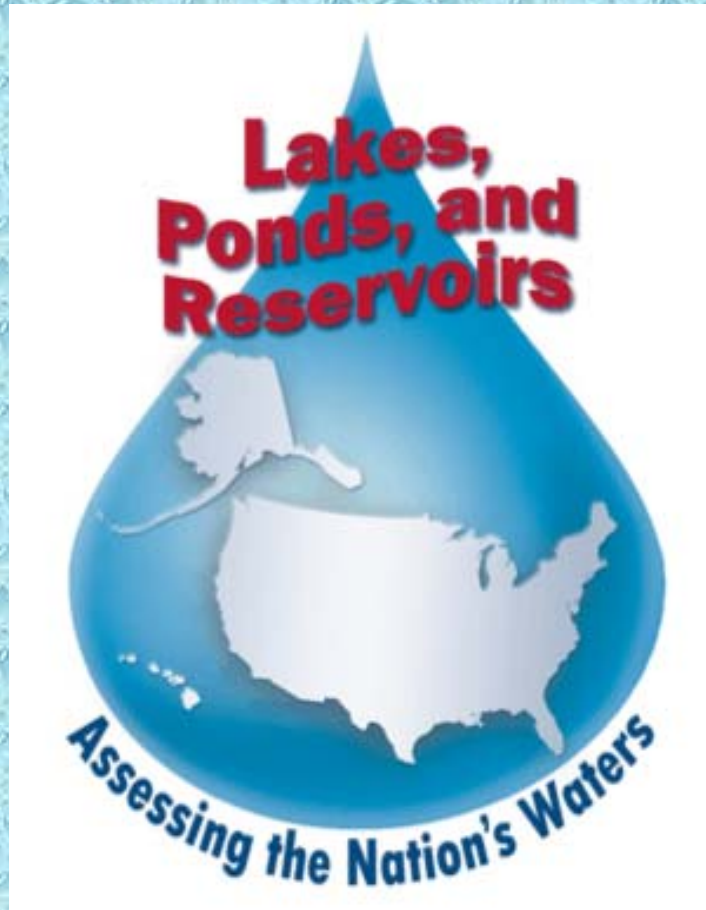


Survey of the Nation's Lakes Workshop



Pelagic Zone Sampling

Overview

- **Discuss parameters sampled from the lake pelagic zone**
- **Describe sampling methods and equipment**
- **Describe sample processing and analysis procedures**
- **Note where questions may exist & provide opportunity for discussion**

Pelagic (Mid-lake) Sampling

- All pelagic samples collected from the Index Site
 - Index Site is located at deepest point in lake
 - Chosen using bathymetric map and/or sonar
 - Limit effort to locate <30 min.

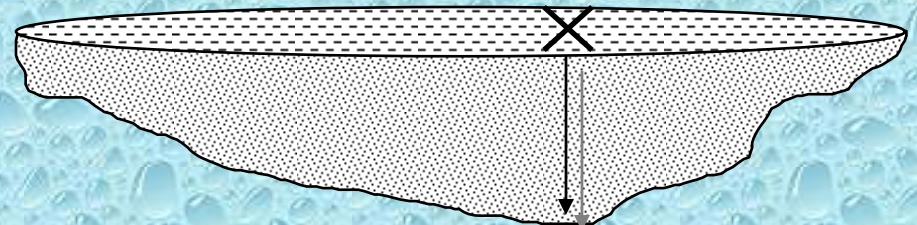


Littoral zone
Sub-littoral zone
Pelagic zone

Index Site
(deepest point)



- Water chemistry
 - Depth-integrated
 - In situ
- Secchi Transparency
- Chlorophyll a
- Phytoplankton
- Zooplankton
- Sediment diatoms
- Algal toxins



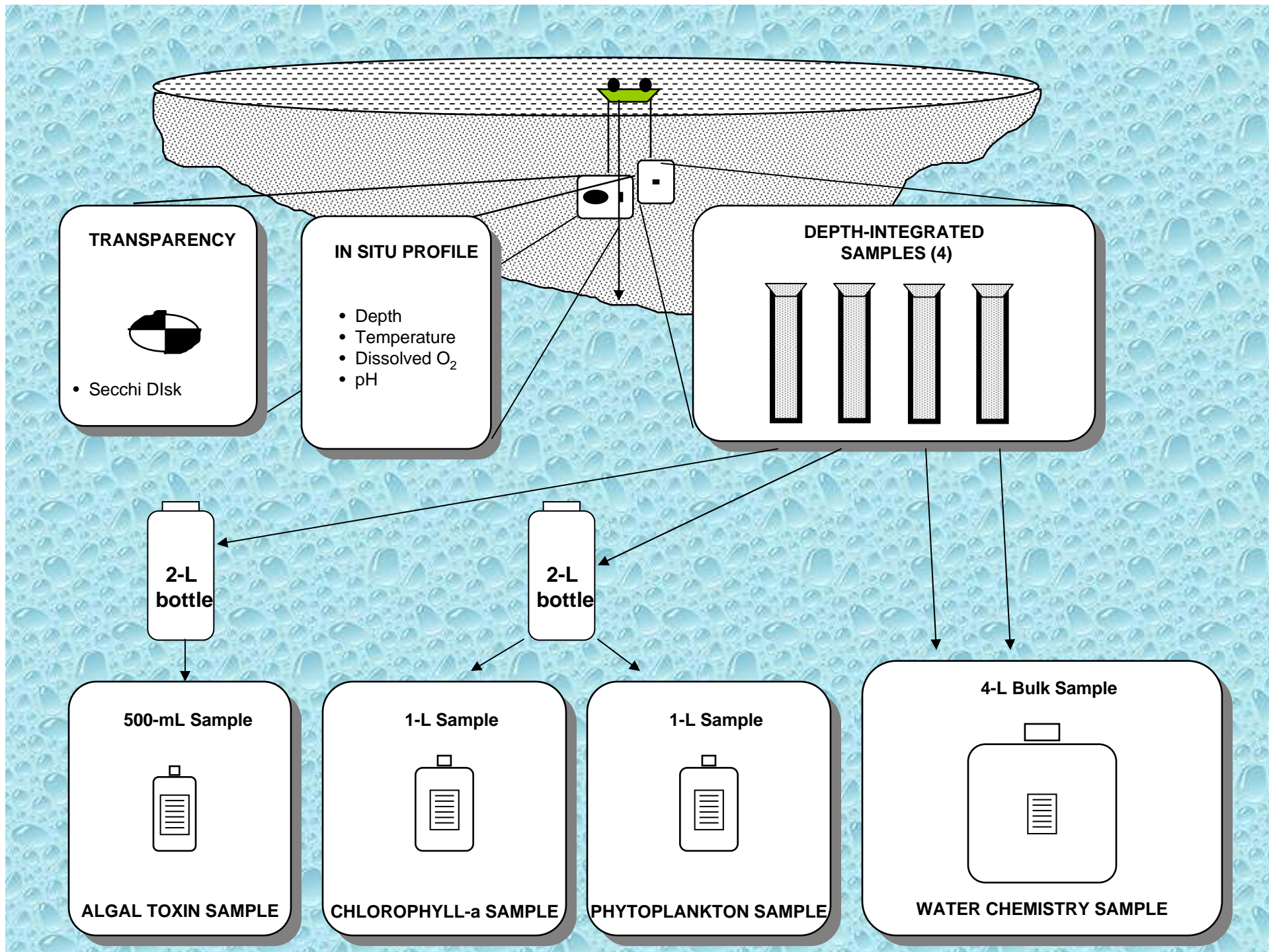
Sampling Parameters

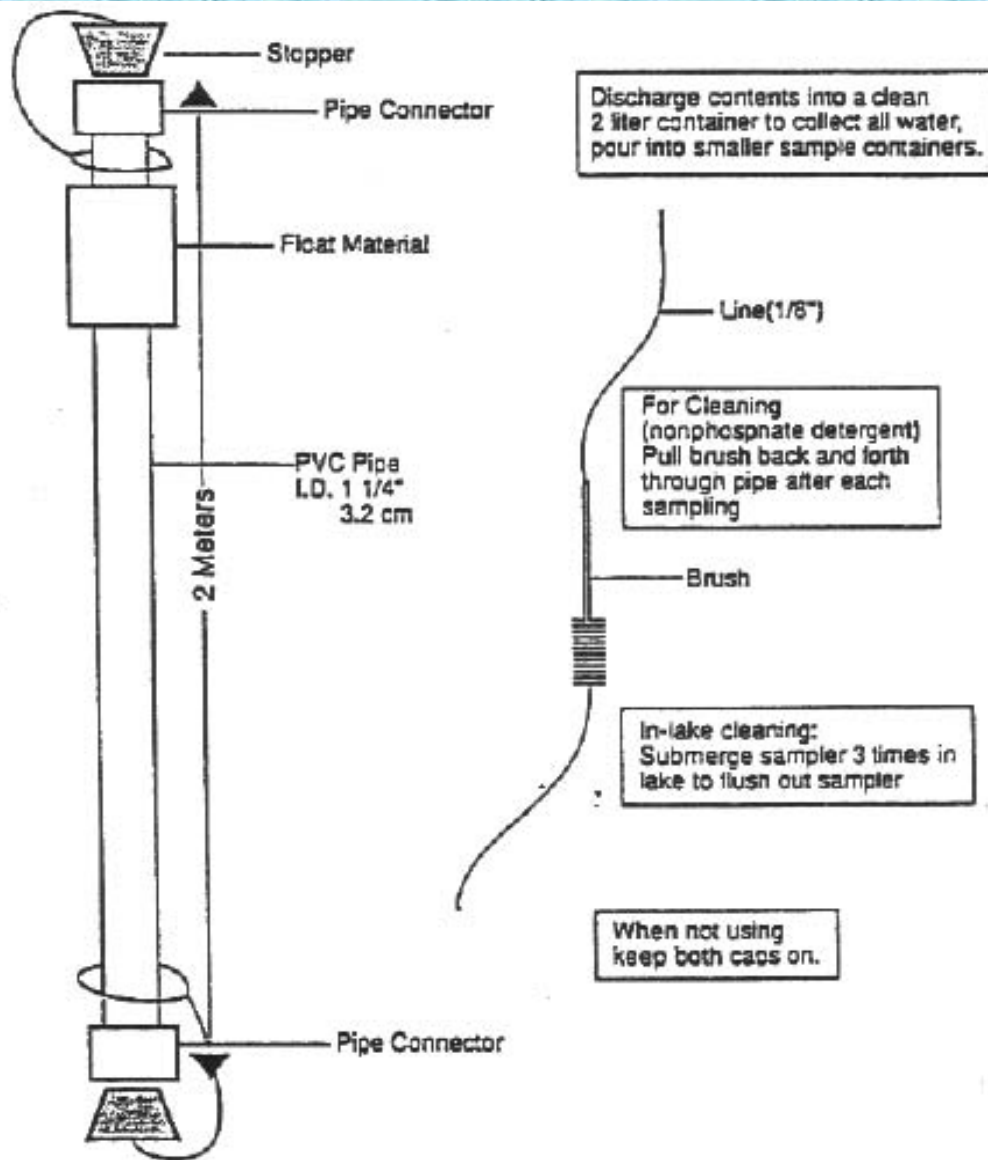
- Water chemistry
 - 2 m Depth-integrated
 - *In situ*
- Secchi Transparency
- Chlorophyll a
- Phytoplankton
- Algal toxins
- Sediment diatoms
- Zooplankton



Water Chemistry

- Depth-integrated sample
 - Collected using integrated water sampler from surface to 2 m depth
 - 4-L composite sample
- *In situ* profile
 - Dissolved oxygen, temperature, pH profile
 - Measured using a multi-probe sonde
 - Conductivity optional





Luer-Lok added to this if closed system samples needed



Integrated water sampler (MPCA)

Water Chemistry Target Analytes

Nutrients, cations, anions & related measures

- Conductivity
- Turbidity
- pH
- Acid Neutralizing Capacity
- Total & Dissolved Organic Carbon
- Ammonia
- Nitrate-Nitrite
- Total Nitrogen
- Total Phosphorus & Ortho-P
- Sulfate
- Chloride
- Nitrate
- Calcium
- Magnesium
- Sodium
- Potassium
- Silica
- Total Suspended Solids
- True Color
- Chlorophyll-a

Water Chemistry Sample Processing

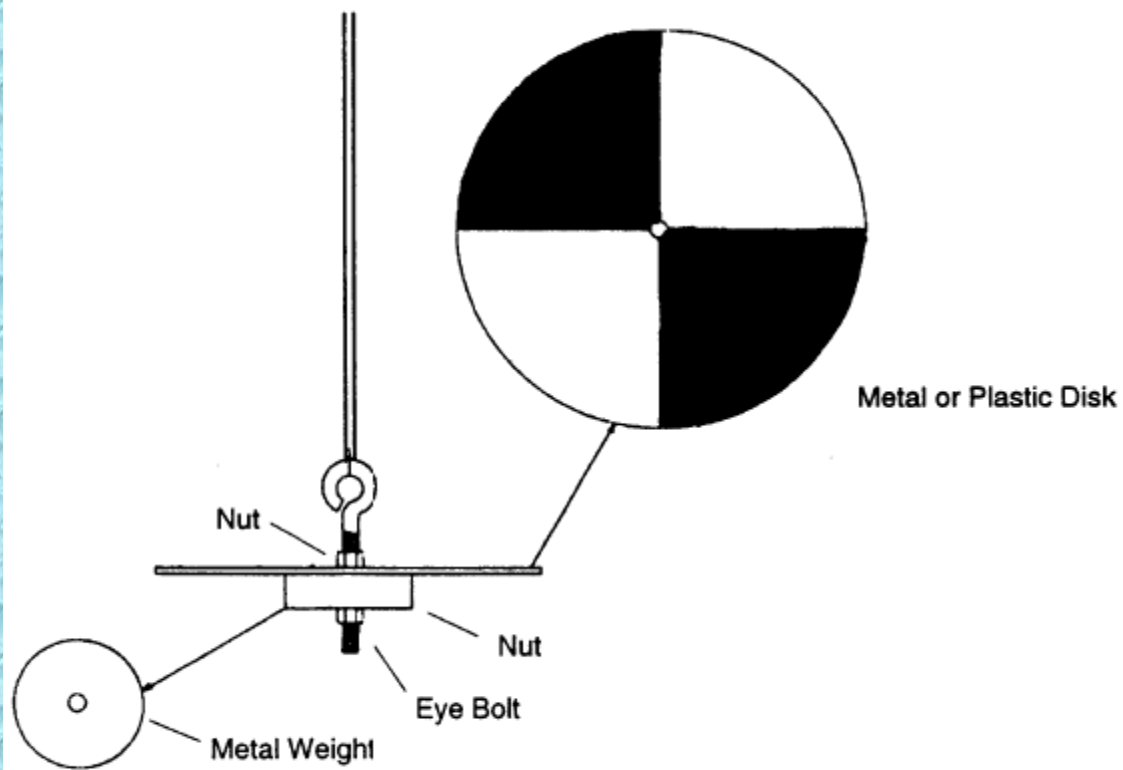
- **Performance-based methods approach**
 - Utilizes defined set of laboratory method performance requirements for data quality
 - Method performance requirements identify detection limit, precision, and accuracy objectives for each parameter
 - Laboratories may choose analytical methods for any target analyte as long as they are able to achieve the stated performance requirements

In Situ Profile

- **Dissolved oxygen, pH, and temperature profile collected using a multi-parameter sonde**
 - Measured at surface, 1 m, 2 m, & every m to 20 m
 - After 20 m, measured at 2 m intervals (larger e.g. 5 m intervals may be needed for very deep lakes)
 - Final reading is taken 0.5 m (revise to 1.0 m?) from bottom
 - If max depth is < 3 m, measure at surface and 0.5 m intervals until 0.5 m above the bottom

Secchi Transparency

- **Readings taken on shady side of the boat (to reduce surface glare)**
 - Measure depth that disk disappears
 - Measure depth that disk reappears
 - Average of the disappearance and reappearance depths is Secchi Depth (i.e. split the difference)
- **Make note if the Secchi disk is still visible at the bottom of the lake**
- **Try to collect between ~10 am – 3 pm if possible;**



Secchi Disk (EPA 1991)



Chlorophyll-a Collection & Processing

- 2 m Depth-integrated sample emptied into 2-L bottle;
- Shake well & filter 100-1000 mL of sample using glass fiber filter (Whatman GF/F or equivalent) and hand pump
 - Volume filtered depends on algal density and/or turbidity of water sample (Secchi can guide decision)
 - Filter until color (typically green but may have brownish hue) is observed on the filter
- Place filter in 50 ml centrifuge tube, wrap in foil, and ice (dry ice?)



Chlorophyll-a Sample Processing

- **Performance-based methods approach**
 - Laboratories may choose analytical method as long as they are able to achieve the stated performance requirements



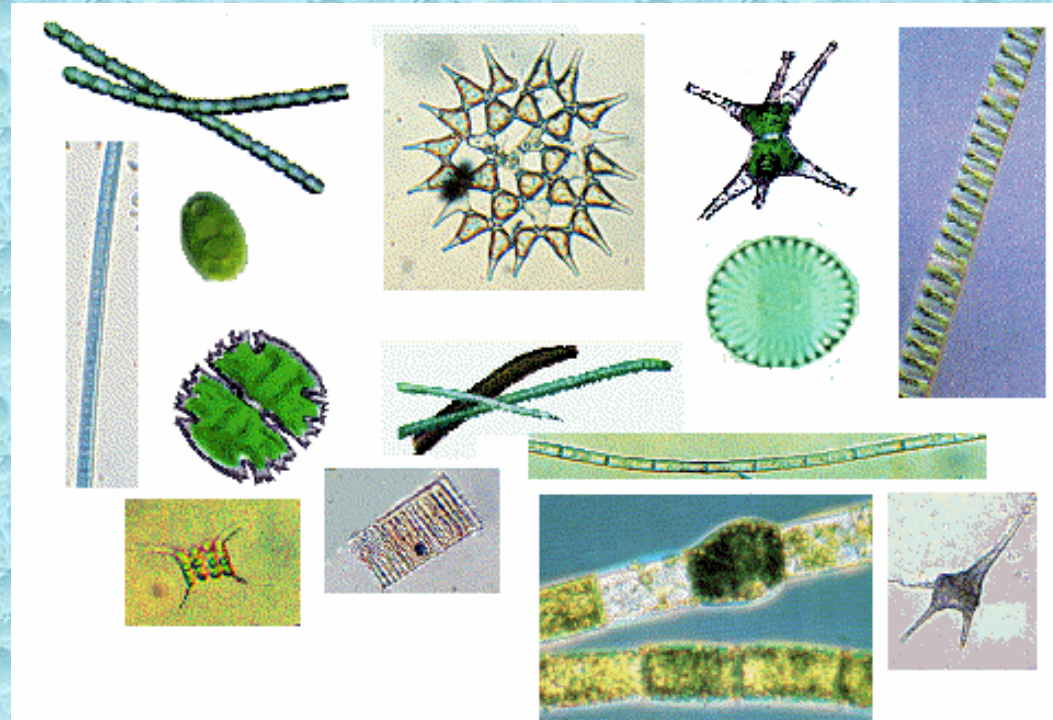
Phytoplankton Collection

- **2 m Depth-integrated sample poured into 2-L bottle and thoroughly mixed before sample is taken;**
- **From 2-L bottle, sample is poured into 125 mL bottle, preserved w/ Lugols, kept in dark (preservative could vary dependant on analyst);**
- **Shipped for lab processing;**
- **Issue raised – collect chl-a, phytoplankton & Microcystin from same sample**



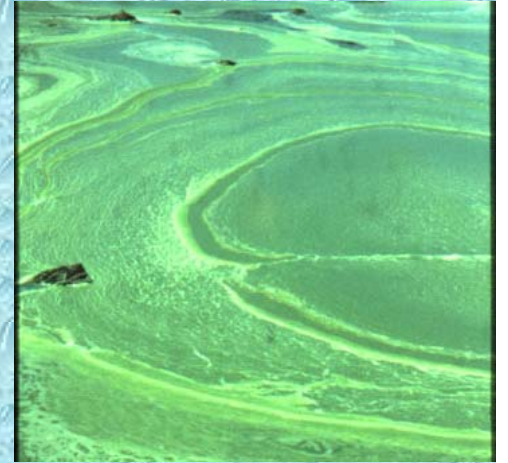
Phytoplankton Sample Processing

- **Concentrate sample**
- **Identify and enumerate 300 algal units**
- **Measure cell biovolumes;**
- **Some issues raised on concentration process**



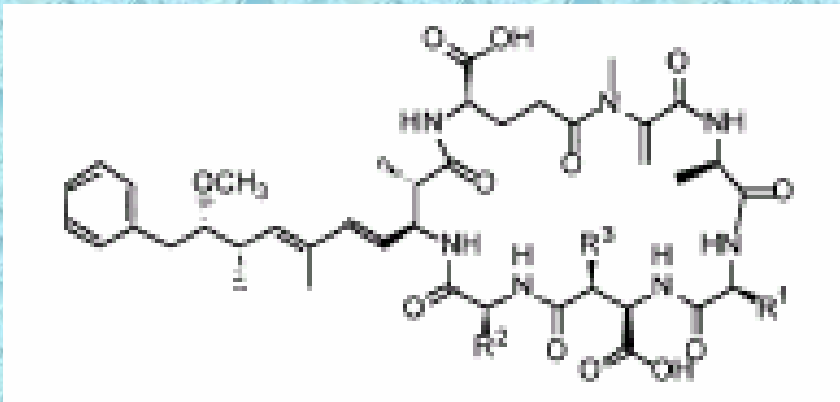
Algal Toxin Collection

- 2 m integrated sample from index site to 2L bottle;
- From 2-L bottle, sample is poured into 500 mL bottle, kept in dark and preserved on ice;
- Shipped to a central lab;
- Issue – ship individually or retain and ship a group of samples?
- Side note – *Based on 48 mid-lake samples in 12 MN lakes in 2006 70% exhibited conc. >1.0 ug/L*



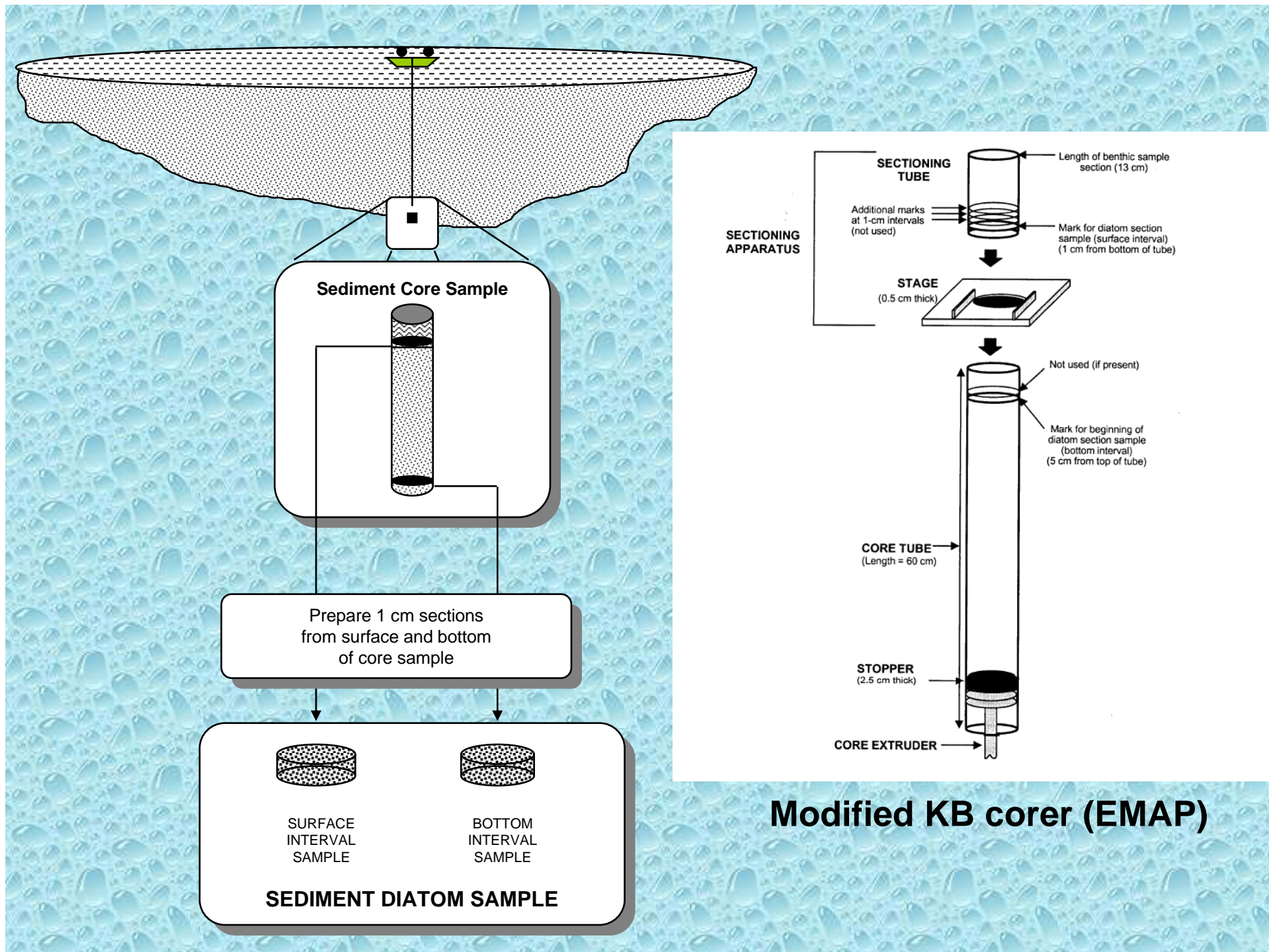
Algal Toxin Sample Processing & Analysis

- Samples to be analyzed at a single lab;
- Measure the presence and abundance of Microcystin;
- Freeze-thaw ELISA-based method likely;

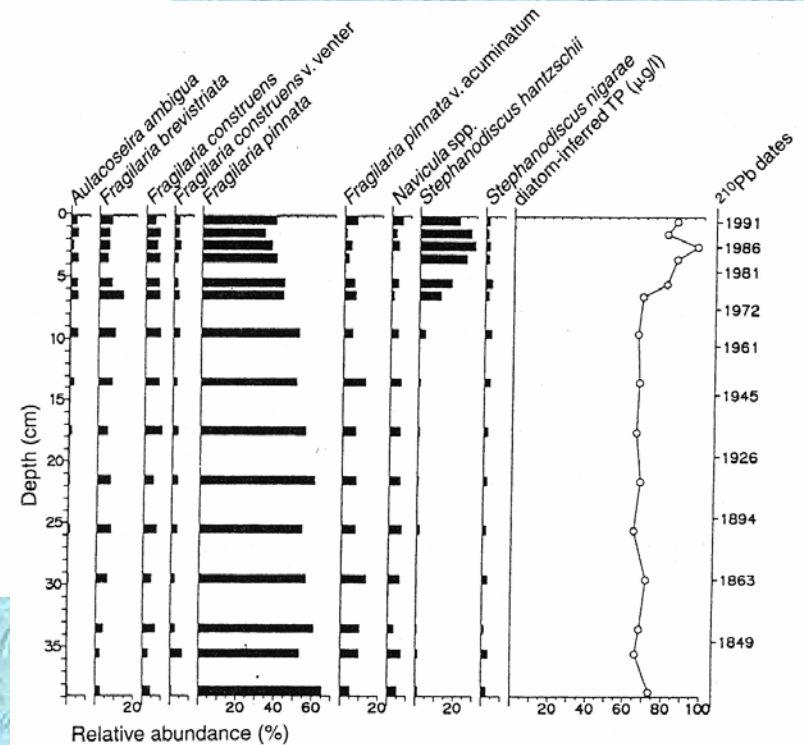


Sediment Diatom Collection

- Determine modern-day and historical WQ based on diatoms preserved in sediment
- Ecological requirements of diatoms well documented
- Single core collected from bottom sediments using modified KB corer
- Target core length 35-45 cm
 - **If desired core length is not achieved, repeat procedure and take a 2nd core**
 - **If the target is still not achieved, use the core sample obtained and note the total length of the core**
- Typically two sections preserved for analysis (only one from reservoirs)
 - **Top 1 cm: represent current conditions**
 - **Bottom 1 cm: represent historical conditions (natural lakes only)**

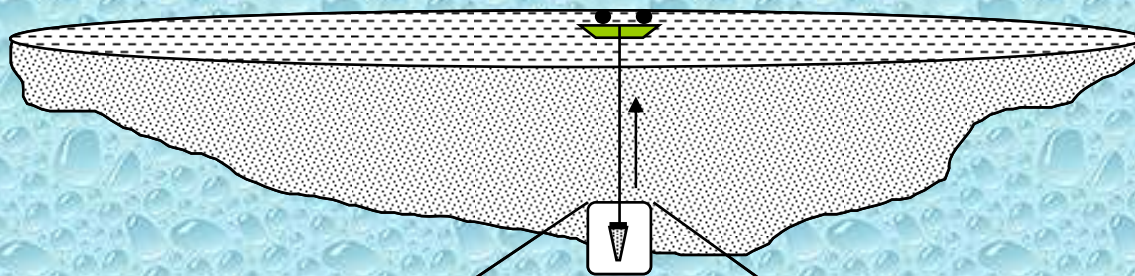


Diatom Sampling & Analysis



Zooplankton Collection

- Single vertical tow using Wisconsin Net (73 μm mesh) from 1 m above bottom to surface
 - If depth at index site is <2 m and the Secchi disk could be seen on the bottom, then conduct a 2nd tow of the same length and combine contents of both tows
- Towed at steady constant rate without stopping (0.3 m or 1 ft per second)
- Specimens should be narcotized (with CO_2) prior to addition of preservative to aid identification
- Sample poured into 125 ml bottle, preserved with 95% ethanol, and sent to lab for analysis



**VERTICAL TOW
(Wisconsin Net)**



NARCOTIZATION

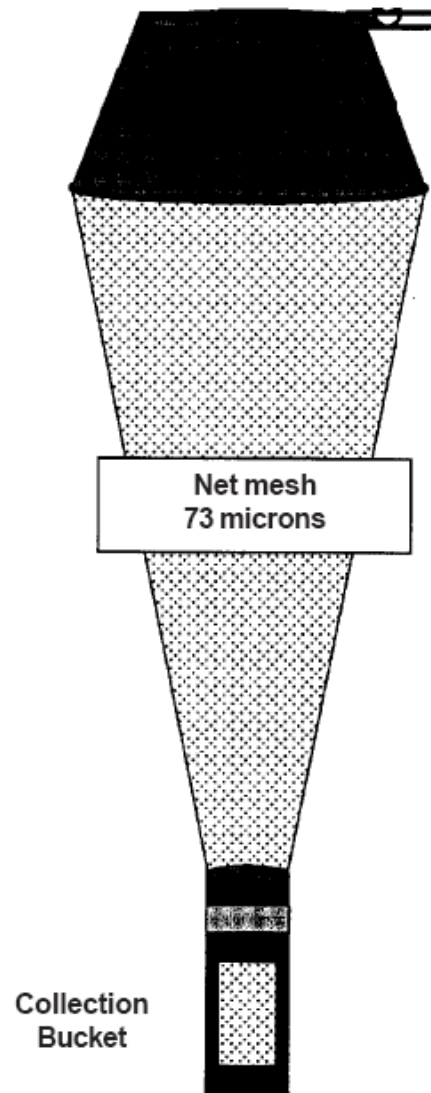
PRESERVATION



ZOOPLANKTON SAMPLE



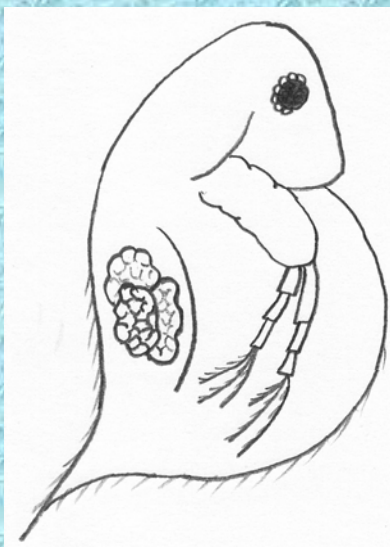
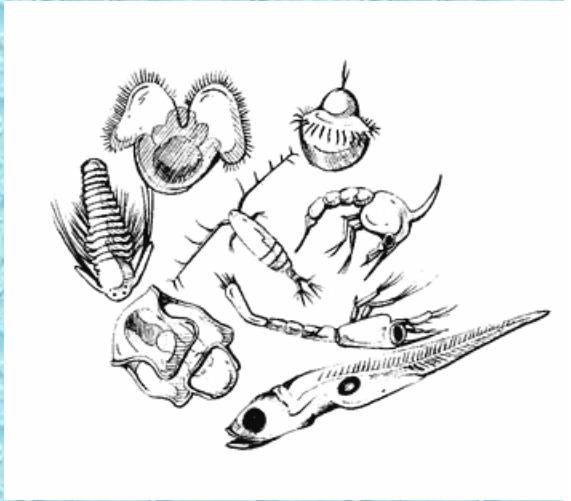
**Issue – Appropriate
net size, i.e. what
organisms to we
seek to collect &
identify?**



Wisconsin Net and collection bucket

Zooplankton Sample Processing

- **Subsample using splitter**
- **Macro & Microcrustaceans identified and enumerated**
- **Rotifer and Nauplii identified and enumerated**



Status

- **Methods have been reviewed by states and tribes**
- **Most methods finalized, but some may be revised based on comments**
 - **pH measurement using multi-probe may replace closed-system syringe collection**
 - **Algal toxin collection and processing procedures still under discussion**
- **All methods will be finalized by year's end**

For more information about the Survey of the Nation's Lakes

- Visit our website:
<http://www.epa.gov/owow/lakes/lakessurvey/>
- Questions or comments email us at:
lakessurvey@epa.gov

